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Edward Jenner and the Conquest of Smallpox

By EDWARD FORD, M.D., D.P.H., F.R.A.C.P., F.Z.S.

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TWO centuries have passed since the birth of Edward Jenner, the Gloucestershire village doctor who discovered vaccination against smallpox. His method of prevention, introduced in 1798, overcame one of the most dreaded of the pestilences, and for this he is honoured as one of mankind's greatest benefactors.

Jenner was one of the great pioneers of preventive medicine, a first investigator of the virus infections, and an acknowledged influence on the later work of Pasteur, upon which modern immunology was founded. He was, as well, a skilled naturalist and a well-loved country doctor.

EARLY LIFE AND TRAINING

On 17th May, 1749, Edward Jenner, the son of a rural clergyman, was born in the small Gloucestershire village of Berkeley, in which he was to spend his long and fruitful days as the local doctor. At the age of 13 years he commenced the usual training for a general practitioner of medicine of that time, by apprenticeship to a country surgeon. He assisted his master in his work and studied under his direction. It is to be expected that he also found time in his leisure hours for the pursuit of natural history, in which he had engaged since his school days, and in which he was to retain a lifelong interest.

At the completion of his apprenticeship in 1770, Jenner went to London to continue his medical studies, and by good fortune became the resident student of John Hunter, one of the masters of British surgery. Hunter was a distinguished comparative anatomist and pathologist, and one of the greatest inves-



Edward Jenner. M.D. F.R.S.

tigators of his time. His application of scientific principles, based on his observation and experiment, to the practice of surgery greatly influenced its development. He was an ardent collector, part of his enormous gatherings forming the Hunterian Collection of the Royal College of Surgeons of England, which was largely destroyed by German bombing in 1941. He kept also a private menagerie for his zoological studies. This famous teacher must have had a profound influence on his young pupil, who lived

with him in his great house, filled with natural history specimens, and busy with constant experiments on the structure and habits of animals.

Despite the attractions of the city, Jenner returned to his village in 1772, and there he remained as the local doctor for the rest of his life. Three years after his return Hunter invited him to work at his school in London, but this tempting offer was refused, as many others that followed in the later days of his success.

At Berkeley Jenner lived the life of a busy physician, was involved in local affairs and interested in natural history, poetry and music. From the accounts of his life we see him as a jovial and friendly country man and a capable doctor, loving his home and family, respected by his friends and colleagues, and interested in the welfare of his neighbours.

JENNER'S STUDIES IN NATURAL HISTORY

Jenner was a keen student of natural history throughout his life. From his earliest days he was interested in the workings of nature, and the training in observation and skill in experiment gained in his natural history studies, fitted him for the work for which he is famed.

Hunter must have been impressed by his competence, for, apart from the later offer of an assistantship, while still his pupil, Jenner obtained through his influence a position which marked his appreciation. In 1771 Captain Cook returned from his first voyage, in the *Endeavour*, after his discovery of our eastern coasts, bringing with him the great collections of Banks and Solander, a large part of which had been gathered at Botany Bay. Through Hunter's friendship with Joseph Banks, Jenner received the part-time work of arranging the botanical specimens. Towards the end of last century the British authorities presented the duplicates of this collection to the State of New South Wales, and they are now at the National Herbarium. Jenner was later offered a position of naturalist with Cook's second expedition, which sailed in the *Resolution* in 1772,



Smallpox.

(From "The Diagnosis of Small-pox", by T. F. Ricketts and J. B. Byles.)

but was not attracted from the village life he had decided upon.

Hunter's influence upon his pupil was maintained through a friendship that endured till the latter's death in 1793, and they corresponded regularly. The letters from Hunter to Jenner, preserved in the Royal College of Surgeons of England, refer mainly to natural history—begging or acknowledging specimens, seeking information, or criticizing experiments. An idea of their nature can be gained from a letter of 2nd August, 1775:

I thank you for your experiment on the hedgehog; but why do you ask me a question by way of solving it? I think your solution is just; but why think? why not try the experiment? Repeat all the experiments upon a hedgehog as soon as you receive this, and they will give you the solution . . . and let me know the result of the whole.

Personal affairs could not distract the energetic master from his work, and after Jenner had apparently written in disappointment at the breaking off of arrangements for his marriage, he replied:

I own I was glad when I heard you was married to a woman of fortune; but 'let her go, never mind her'. I shall employ you with hedgehogs, for I do not know how far I may

trust mine. I want you to get a hedgehog at the beginning of winter. . . .

And there follows the details of an experiment, and no more of Jenner's troubles.

Included in Jenner's work on natural history were studies on the habits of the cuckoo, hibernation in the hedgehog, and bird migration. In his publication on the cuckoo he described the manner in which the young cuckoo removes its foster nestlings from the nest, and noted, among other features, that the young bird had a

object of universal fear. The historian Macaulay described it as "the most terrible of all the ministers of death . . . always with us . . . filling the churchyards with corpses, tormenting with constant fear all those it had not stricken, leaving on those whose lives it spared the hideous traces of its powers, turning the babe into a changeling at which its mother shuddered, and making the eyes and cheeks of the betrothed maiden an object of horror to the lover."

A mother with smallpox nurses her healthy vaccinated baby.

(From "Modern School Hygiene", by R. Gamlin, 1936.)



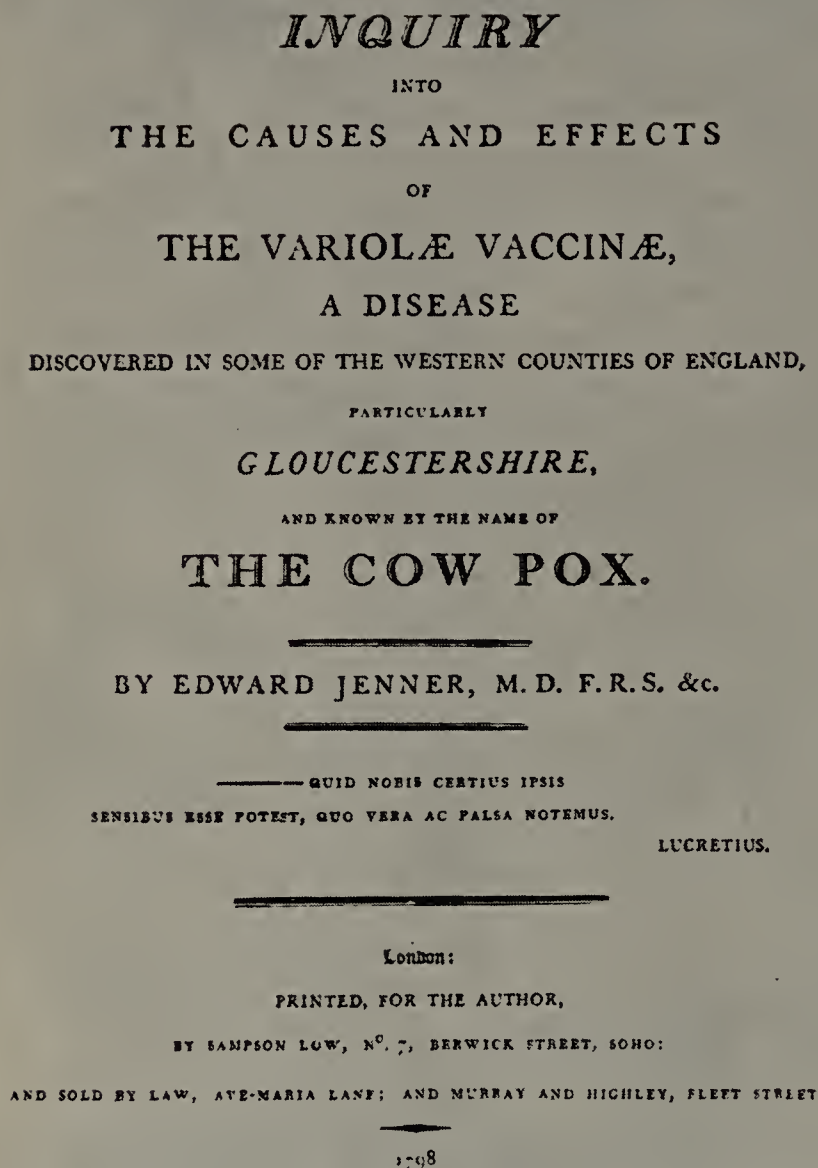
depression on its back which appeared to aid in this purpose, and which disappeared about its twelfth day. This work suffered much criticism and was later held in discredit, though in recent days its accuracy has been proved.

SMALLPOX AND INOCULATION

Prior to vaccination, smallpox was one of the most deadly and dreaded diseases. It smouldered in the cities and spread at intervals in devastating epidemics. It killed one person of each six or seven attacked, and probably half to five-sixths of people were infected at some time in their lives. Its heavy mortality and extreme contagiousness, its menace to all who had not yet been infected, and its loathsome manifestations made it an

In the century preceding Jenner's discovery some protection against smallpox had been attained in Britain by the adoption of an ancient Eastern method of immunization. This measure, termed inoculation, was based on the fact that immunity was induced by an attack of smallpox, and was performed by the application of matter taken from a true case of the disease.

This was introduced in 1714 and was strongly advocated by Lady Mary Wortley-Montagu, wife of the Ambassador at Constantinople, upon her return to England. Lady Mary, whose own children had been inoculated, pressed for its adoption with a vivid energy worthy of one called "the she-meteor" by Horace Walpole. Her campaign was successful,



Title page of Jenner's "Inquiry", 1798.

and the method achieved a limited use, which was sanctioned by the Royal College of Physicians in 1754.

The method generally used was to apply material from an early smallpox lesion to a scratch or incision. This caused an attack of smallpox, which resulted in immunity. In most cases infection was mild, but occasionally severe attacks were incurred, and a case mortality of from 1 to 6 per cent. resulted. Another serious defect rested in the liability of the spread of smallpox from persons so inoculated. These were as contagious as naturally infected cases, and severe outbreaks at times occurred when treated persons were not effectively isolated. From its limited use inoculation had slight effect on smallpox in the mass of the people. Its use waned after the introduction of vaccination, and in England it was prohibited by law in 1840.

COWPOX AND VACCINATION

From his apprenticeship days Jenner was aware of a rural tradition that dairy-maids having contracted cowpox subsequently would not suffer from smallpox. After considering this for many years, he at length carried out the investigations which showed that cowpox infection gave protection against smallpox, and which were the basis of the method which he termed vaccination.

It was at first necessary to show that the cowpox naturally acquired by milk-maids protected them. As Jenner used smallpox inoculation in his practice, this was readily proved by the freedom of reaction to the smallpox material of previous cowpox sufferers.

This was followed, in 1796, by his first experiment on vaccination. An eight-year-old boy, James Phipps, was vaccinated with matter from a cowpox lesion on the finger of a milkmaid, Sarah Nelmes. The boy was successfully infected with cowpox, and was later inoculated from a case of smallpox. No infection resulted—the cowpox had protected him.

Further investigations were made, and in 1798 Jenner published his great work, *An Inquiry into the Causes and Effects of the Variolæ Vaccinæ, a Disease Discovered in Some of the Western Countries of England, Particularly Gloucestershire, and Known by the Name of Cow Pox*. Certain of his facts, Jenner went to London to demonstrate his discovery. He remained there for some months without finding any persons willing to be vaccinated, and returned home. But his method was taken up enthusiastically by others, and within a few months was in wide use.

During its rapid adoption frequent setbacks were encountered, from such things as faulty technique, the wrong selection of lesions in the cow as a source of lymph, and too early exposure to smallpox, but such defects were gradually overcome. Though Jenner's thesis was based on few cases, within a short time its effectiveness was proved beyond all doubt, both in large scale tests and by its widespread usage.

Jenner thought that the immunity received from vaccination persisted throughout life, but it was in time shown that it gradually decreased, but could be restored by revaccination.

Coincidental with its grateful reception, there arose a vehement opposition to vaccination, expressed in personal attacks upon Jenner, professional criticism, lampoons and caricatures. A modicum of this persists to the present day from persons who disregard all evidence, and most of whom, because of Jenner's work, have never looked on the horror of the disease.

It may appear from this brief account that Jenner's task was merely the easy proving of a country tale. But he went far beyond the obvious implications of this. He considered not only the protection of individual persons by the lymph he obtained from the pocks of the cow disease. This had been already done, in 1774, by a Dorsetshire farmer, Benjamin Jesty. In addition, Jenner conceived the idea, essential to its wide use as a public health measure, of passing the cow virus from person to person. He envisaged the protection of whole populations, and clearly saw in it the means of ending the menace of smallpox to the race.

Vaccination was quickly adopted in Europe and America, and was soon in world-wide use. In 1803 Governor King requested the Secretary of State that a supply of "vaccine matter" should be sent to New South Wales, mentioning that the cows of the Colony had been examined, without result, for cowpox. This was received in 1804, and children were at once vaccinated, and a scheme instituted for its wide utilization. The cowpox virus was maintained on the long voyage by passing it from one person to another, in an unbroken succession of vaccinations. Such uninterrupted arm-to-arm transfer, required to prevent the loss of the protective virus, was continued till about 1881, when the manufacture of storable calf lymph was introduced. Prior to this the virus died out a number of times in Australia and had to be reintroduced.

In the years since its introduction in 1798, the method of vaccination has been little changed. It has passed with unaltered effectiveness to our day, and remains, as Jenner presented it, a great weapon of the public health, and a sure protection from smallpox to all who use it.

